REMARKS

The application has been reviewed in light of the final Office Action dated October 16, 2008. Claims 1-17 are pending in this application. By the present Amendment, claim 1 has been amended to clarify that the interval at which the sequential ink drops is discharged in the given printing cycle is substantially equal to (n x Tc) + (Tc /2) but not equal to n x Tc. Claims 1-17 would remain pending in this application upon entry of this Amendment, with claim 1 being the sole pending claim in independent form.

Claims 1-3 and 7-17 were rejected under 35 U.S.C. §102(b) as purportedly anticipated by Kusunoki '671 (US 2004/0207671 A1 or WO 2003/026897). Claims 4-6 were rejected under 35 U.S.C. §103(a) as purportedly unpatentable over Kusunoki '671. Claims 1-17 were rejected under 35 U.S.C. §103(a) as purportedly unpatentable over Ishikawa (U.S. Patent No. 6,254,213) in view of Matsuo (U.S. Patent No. 6,488,349). Claims 1-17 were rejected under 35 U.S.C. §103(a) as purportedly unpatentable over Kusunoki '912 (US 2003/0001912 A1) in view of Matsuo.

Applicant respectfully submits that the present application is allowable over the cited art, for at least the reason that the cited art does not disclose or suggest the aspects of the present application of discharging one or more of the sequential ink drops other than an ink drop that is not followed by any more of the ink drops in a given printing cycle (the last ink drop) at an interval substantially equal to (n+1/2) x Tc ***but not equal to n x Tc***, that is, the interval at which the one or more of the sequential ink drops is discharged in the given printing cycle is substantially equal to (n x Tc) + (Tc /2) ***but not equal to n x Tc,*** such that the sequential ink drops merge before reaching a print target medium. Independent claim 1 addresses such aspects, as well as additional features.

As discussed in the present application ([0114] through [0138]), superior performance (for example, larger merged droplet, greater stability, superior suppression of residual pressure vibration, etc.) is obtained when the ink drops other than the last ink are discharged at an interval substantially equal to (n x Tc) + (Tc /2) but not equal to n x Tc, as compared to when adjacent driving pulses in a driving signal are spaced by an interval that is a multiple of the resonance period Ts.

As discussed in the record, Kusunoki '671, as understood by applicant, proposes an approach for driving a pressure generation part in a droplet discharge head, wherein adjacent driving pulses in a driving signal are ***spaced by an interval that is an integer multiple*** of the resonance period Ts of the pressure vibration of the pressurizing chamber ('671, [0117]). Kusunoki '671 does not disclose or suggest that such interval can be any spacing other than an integer multiple.

Kusunoki '671 simply does not disclose or suggest discharging one or more of the ink drops, other than the last ink drop in a given printing cycle, at an interval ***substantially equal to (n x Tc) + (Tc /2) but NOT equal to n x Tc***, where n is an integer equal to or greater than 1.

Kusunoki '671 teaches away from such aspect of the present application. As the United States Supreme Court recently reiterated in the KSR case, such teaching away is relevant evidence of nonobviousness and cannot be ignored.

It is contended in the Office Action that an interval of n x Tc is "substantially equal" to an interval of (n+1/2) x Tc (notwithstanding applicant's repeated explanation in the record and the specification to the contrary).

However, the claim amendment herein, and as pointed out in the application, [134] and [135], an interval of n x Tc is ***not*** "substantially equal" to an interval of (n+1/2) x Tc. Rather, as

explained in paragraphs [0019], [0134] and [0135] of the application, these two different intervals (physical limitations) have vastly different functional results when used to discharge ink drops.

Ishikawa, as understood by applicant, proposes an ink droplet jetting apparatus, wherein a frequency of consecutive pulses in a driving signal applied to an actuator is controlled for forming respective consecutive dots at a timing of (N + 0.5) x T, where T is the time in which a pressure wave propagates within an ink chamber in one propagation direction.

However, Ishikawa, as acknowledged in the Office Action, does not involve formation of a large ink drop by multiple merging small ink drops. The apparatus proposed in Ishikawa discharges a plurality of ink drops for forming respective dots on the recording medium.

Ishikawa does not disclose or suggest, however, that such timing can obtain beneficial results when it is used to form sequential ink drops that merge before reaching a print target medium.

Applicant submits that one of ordinary skill in the art would not have deemed Ishikawa to be relevant to the context of the present application wherein sequential ink drops merge to form a larger ink drop prior to reaching a print target medium.

Matsuo, as understood by applicant, proposes an ink jet head comprising a driving signal supply means for supplying a driving voltage signal including a plurality of driving pulses to a piezoelectric element of an actuator, under a condition of $t1 \leq t2 \leq t3 \leq t0$, wherein t0 is the natural period of the actuator, t1 is a first time from a start of potential decrease in the potential decreasing waveform to an end of potential increase in the potential increasing waveform in the initial driving pulse, t2 is a second time from a start of a potential holding in a positive pressure potential holding waveform to an end of potential increase in a potential increasing waveform in

the first subsequent driving pulse, t3 is a third time from a start of potential holding in a positive pressure potential holding waveform to an end of potential increase in a potential increasing waveform in the second subsequent driving pulse. The corresponding driving pulses are configured such that ink droplets are discharged from the nozzle with discharge velocity gradually increasing, resulting in ink droplets merging before striking the recording medium.

Thus, in the apparatus proposed by Matsuo, each of consecutive intervals t1, t2, t3 is longer than the preceding interval, and each interval is ***less than or equal to*** t0, the natural period of the actuator.

Further, Matsuo teaches:

> "It is preferred that the driving signal supply means supplies the plurality of driving pulses so that the time interval between the driving pulses gradually increases ... so as to approach the natural period of the actuator (i.e. driving intervals < natural frequency), whereby the overall time interval of the driving pulses is shorter than that when the time interval gradually decreases so as to approach the natural period (i.e. driving intervals > natural frequency). Therefore, it is possible to reduce the printing cycle, thereby enabling printing at a higher speed." (Matsuo col. 2, line 63 to col. 3, line 5).

Thus, Matsuo ***teaches away*** from a driving signal having discharge intervals greater than the natural frequency of the actuator. Given this teaching away, it would not have been obvious to combine the teachings of Matsuo with Ishikawa or Kusunoki '912, both of which disclose discharge intervals greater than the natural frequency of the actuator. Such teaching away is relevant evidence of nonobviousness and cannot be ignored.

Also, Matsuo does not disclose or suggest, that advantageous results can be obtained by discharging the ink drops other than the last ink at an interval substantially equal to (n x Tc) + (Tc /2), where n is an integer equal to or greater than 1, when sequential ink drops merge before reaching a print target medium.

Even with knowledge of Matsuo, one skilled in the art would not have looked to modify the apparatus proposed by Ishikawa to obtain a modified apparatus for discharging sequential ink drops wherein the sequential ink drops merge before reaching a print target medium, since such modification would have entailed a substantial overhaul of the design of the image forming apparatus.

Kusunoki '912, as understood by applicant, proposes an ink jet recording apparatus comprising a driving signal generator, wherein the driving signal generator generates an expansion pulse for increasing the capacity of the pressure chamber and a contraction pulse for reducing the capacity of the pressure chamber with a timing such that a time lag between the respective centers of the expansion pulse and the contraction pulse matches the resonance period of a meniscus generated in the nozzle by the ink in the pressure chamber.

However, as previously noted, Matsuo teaches away from a driving signal having discharge intervals greater than the natural frequency of the actuator. Given such teaching away, it would not have been obvious to combine the teachings of Matsuo with Kusunoki '912 in the manner contended in the Office Action.

Applicant submits that the cited art, even when considered along with common sense and common knowledge to one skilled in the art, does not render unpatentable the above-mentioned aspect of the present application of discharging one or more of the sequential ink drops other than an ink drop that is not followed by any more of the ink drops in a given printing cycle (the last ink drop) at an interval substantially equal to (n+1/2) x Tc ***but not equal to n x Tc***, that is, the interval at which the one or more of the sequential ink drops is discharged in the given printing cycle is substantially equal to (n x Tc) + (Tc /2) ***but not equal to n x Tc,*** such that the sequential ink drops merge before reaching a print target medium.

Accordingly, applicant respectfully submits that independent claim 1 and the claims depending therefrom are patentable over the cited art.

In view of the remarks hereinabove, applicant submits that the application is now in condition for allowance. Accordingly, Applicant earnestly solicits the allowance of the application.

If a petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition. The Patent Office is hereby authorized to charge any fees that are required in connection with this amendment and to credit any overpayment to our Deposit Account No. 03-3125.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Respectfully submitted,

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